PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.:		10/608,169	Confirmation No.: 8244
Applicant	:	Thomas J. McIntyre	
Filed	:	June 26, 2003	
TC/A.U.	:	2825	
Examiner	:	Lavarias, Arnel C.	
Title	:	FEEDBACK CONTROLLED PHOTONIC FREQUENCY SELECTION CIRCUIT	

Docket No.	:	BA-00577
Customer No.	:	22500

DECLARATION UNDER 37 C.F.R. § 1.131

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

1. I, Thomas J. McIntrye, do declare and state:
2. I am co-inventor along with Charles N. Alcorn of the above-identified application titled Feedback Controlled Photonic Frequency Selection Circuit which is the subject of U.S. Patent Application 10/608,169.
3. That Invention Disclosure, BA-00577, which is attached hereto was prepared by me or my co-inventor.
4. All dates on the attached exhibit have been masked unless otherwise stated herein by reference to specific dates.
5. Prior to November 2002, I, along with my co-inventor. Charles N. Alcorn, completed our invention which is described and claimed in the above-identified application. This was before the date of the printed publication to Rabiei et al. (P. Rabiei, W.H. Steier, C. Zhang, L. R. Dalton, "Polymer Micro-Ring Filters and Modulators", J Lightwave Tech., Vol. 20, No. 11, November 202, pp 1968 – 1975.

6. I along with my co-inventor, Charles N. Alcorn, worked on the invention with due diligence from conception prior to November 2002 to a filing of the application on June 26, 2003. As can be seen from comparing the Invention Disclosure BA-00577 to the patent application, the inventions are the same, note the drawing is the same in both. All work took place in the United States of America.

I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under §1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Date: 12/5/08

Thomas J. McIntyre

Invention Disclosure

Under Evaluation
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Invention Title		
Feedback Controlled Photonic Frequency Selection Circuit and method for making same		
Disclosure No BA-00577	**Functional Manager** Bullock, D. A. (Durwin)	**Receiving Date/Time**
Patent Attorney Gomes, David W	**Technical Review Person** Orlowsky, B. E. (Brian)	**Functional Area** BAE - Space Eng. & Design Services

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Problem:	Current state-of-the-art microphotonic resonator switches turn off with the application of heat from a nearby resistor. The switch is either at ambient temperatures and adding or dropping the frequency it is tuned to by virtue of its size and refractive index or it is heated and the refractive index changed such that the switch no longer picks up or resonates at the selected frequency and so is off. If the temperature of the heater could be precisely controlled, then the temperature of the photonic resonator could be changed in a deliberate step manner such that the refractive index would also change in a deliberate step manner. With this more deliberate setup the resonator could be changed to a specific refractive index and thus pick off selective frequencies - making an on/off switch a variable tunable switch. The problem comes in that the temperature of the resonator must be precisely controlled to pick off the desired frequency. The setup as described above has no feedback loop for control and thus is limited to simply turning on or off.
	This invention proposes adding a feedback loop to the photonic heater/resonator combination in the form of an imbedded resistor with Kelvin connections hooked to readout (logic) circuitry and process for same. The sensing resistor (such as a segment of aluminum) acts as a

Solution:	thermometer. Its temperature coefficient of resistance is well defined. The feedback loop consists of a sensing resistor (such as segment of aluminum) that changes resistance linearly with temperature. This would be imbedded (using standard micro processing techniques during manufacture of the photonic device) in close proximity to the photonic resonator. The sensing resistor would be patterned such that the part of the feature close to the heater material would neck down to micron or even submicron dimension in order to be placed close to the resonators. Kelvin connections will be made to both ends of the small resistor so that contact and series resistances of the connections to the resistor can be ignored. Process: The photonic resonator and heater would be made through standard microphotonic processing techniques. The shape, size, refractive index and materials of the resonator or the heater are not germane to this invention (do not matter). The invention can support any sort of resonator/heater design or material. The feedback resistor can be patterned at the same time as the heater resistor and made of the same material or it can be fabricated separately with separate materials. If done at the same time the heater resistor and the feedback resistor would be wired on separate loops and separated in the horizontal X/Y plane. Ideally in the simplest case they would be separated by exactly the same amount as the heater from the resonator with the same material between each of the elements. However, any small differences in proximity could be accounted for by the control algorithm. The heater and sensing resistor need to be separated enough with a layer of passivation from the optical elements so as to avoid optical coupling. Ideally the passivation would be planarized with either reflow, etch or chemical mechanical processing techniques. A layer of conductor would then be put down (for example 5,000A sputtered Aluminum with 0.5% copper). The conductor would then be patterned and then etched with standard microlithography and etch techniques. Another layer of passivation would then be put down (for example 3 microns of PECVD TEOS). The chip would then go through another round of patterning and etching to open up holes or vias through the passivation so the bond pads are open and the heating resistors and sensing resistors can be connected to drive circuitry. Feedback from the sensing resistor would then be used by logic circuits to control the amount of current (and thus the amount of heating) through the heater resistor. The drawing shows the heater being either over or under the entire resonator. The sensing resistor shows over the heater. In this case the heating resistor and sensing resistor are put down and patterned in separate steps with passivation in between the conductive layers. Done this way the heater material can be different from the sensing material.

Evaluation Questions	*Lockheed Martin Proprietary Information, Attorney-Client and/or Work Product Privileged Information*

If this problem has been solved before, how was it solved?	Heaters have been added to photonic circuitry to turn resonators on and off but have not to our knowledge been used in a controlled fashion to pick off selected frequencies.
Why is your solution better?	This invention will allow controlled heating of the individual resonators to a specific temperature such that the refractive index of each of the resonators can be individually and precisely controlled. This allows the photonic switch to change from a binary on/off device to a variable switch capable of picking off selected frequencies.
Which actual or potential competitor would want to use your solution?	Any photonic manufacuter or design house would be interested in this invention.

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Please provide keywords to be used in the event a patent search is performed:	Photonics, ring resonators, photonic frequency switching, photonic resonators, dense wavelength division multiplexing
Please provide an abstract of your invention:	This invention proposes adding an imbedded feedback loop to the heater/photonic resonator combination in the form of an imbedded resistor hooked to readout circuitry and process for same. The photonic resonator can be driven to a predetermined temperature regardless of ambient temperature by using this imbedded feedback loop. This will allow for precise, controlled, variable tuning of frequency selection for the photonic resonator.

Critical Date Information	*Lockheed Martin Proprietary Information, Attorney-Client and/or Work Product Privileged Information*
Divulgation Notice	
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Estimated date invention reduced to practice:	
Invention used in product previously, presently, or in the future?	No
If so, Product Name?	
Has a product, including the invention or made with the invention, been sold or offered for sale?	No
If so, estimate when?	
If the invention pertains to a process, have any steps been	

taken to employ the process commercially (e.g. for product production)?	No
If so, estimate when?	
Has the invention been described in an electronic or printed publication, or disclosed in a talk or paper presented at a public meeting?	No
If so, estimate when?	
If so, where?	
Has the invention been publicly demonstrated or used?	No
If so, estimate when?	
If so, where?	
Has the invention been otherwise described to persons who are not employees of Lockheed Martin (e.g. to vendors or customers)?	No
If so, estimate when?	
If so, where?	
If so, was the invention disclosed under a Proprietary Information Exchange Agreement?	No
If there has been no public use, sale, divulgation (e.g. publication), is any of these now contemplated?	No
If so, estimate when?	
If so, where?	

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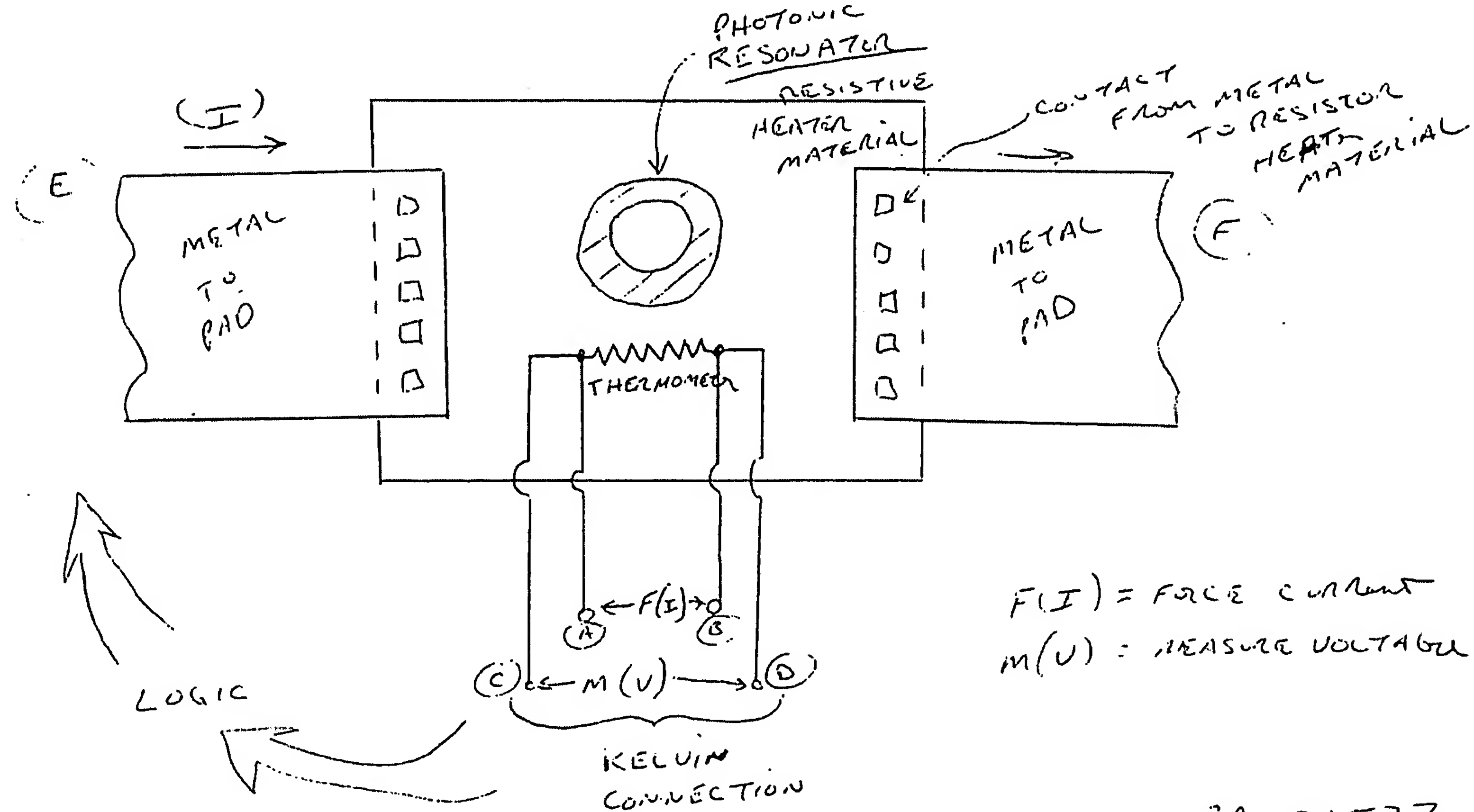
Critical Date Comments:	None

Contract Information	*Lockheed Martin Proprietary Information, Attorney-Client and/or Work Product Privileged Information*
Was the invention first conceived or reduced to practice in the performance of work under a U.S. Government contract?	No
If so, please identify the program name:	
If so, please identify the contract number:	
If so, please identify the P.O. number:	
If a subcontract, please identify the customer:	

Attachments
There are no attachments for this invention disclosure



F(I) = FORCE CURRENT
M(V) : MEASURE VOLTAGE

BA-00577

THE THERMOMETER SHOWN CAN BE SOMETHING AS SIMPLE AS A SHORT
LENGTH OF ALUMINUM WIRE. CURRENT IS FORCED ACROSS THE SEGMENT
FROM A TO B. VOLTAGE IS MEASURED FROM C TO D. THE MEASURED
RESISTIVITY IS THEN ROUTED TO A LOGIC CIRCUIT SO THAT THE CURRENT
CAN BE CONTROLLED TO THE HEATER MATERIAL (E TO F) IN A CONTROLLED
FEEDBACK LOOP. TEMPERATURES ABOVE AMBIENT CAN NOW BE SET AND
CONTROLLED REGARDLESS OF AMBIENT TEMPERATURE ITSELF.
THE INPUT AND OUTPUT WAVEGUIDES TO THE RESONATOR ARE
NOT SHOWN IN THIS DRAWING.

Tom McGr...
Charles ...